Among the Night People. By Clara Dillingham Pierson. Pp. xi+221. (London: John Murray, 1903.) Price 5*s.*

THIS is an American book, for American children, and about American nocturnal animals; but, if we are not mistaken, it will interest English children too, and may be of no small value in letting them into some of the secrets of the life of "the Night People" of the world in general. It consists of a series of stories or sketches of the doings of raccoons, musk-rats, skunks, mice, weasels, foxes, moths, fireflies, &c., told without any affectation in simple language, and with an evidently real knowledge of the habits and characteristics of these creatures, and with a gentle humour which aptly conceals the instruction conveyed. The animals are, of course, humanised to some extent, and talk the language of human beings, but this is managed with such skill, that the animal characteristics are quite adequately retained. A good example is the story of the inquisitive weasel, where a phlegmatic black-tailed skunk is made to play with most amusing effect on the lively curiosity of these little animals, which are the same all the world over. The illustrations of scenes in the dark, by Mr. F. C. Gordon, are very happily conceived and executed.

Qualitative Chemical Analysis. By John B. Garvin, B.S. Pp. viii+241. (Boston: Heath and Co., 1902.) Price 3*s.* 6*d.*

IT is rare in these degenerate days to find an enthusiast for the teaching of qualitative analysis, who regards it as "a source of joy to the majority of normal minds," and as affording "the keenest delight and satisfaction." For analysis, as it is taught, is usually an arid tract, which the student is compelled to traverse on the way to earning a grant or receiving a degree, not a fertile country which he can cultivate with profit and pleasure. Yet one is bound to confess that these pages reflect the author's interest in his subject, and leave the impression that, in the hands of such a teacher, analysis might possess the attributes he describes. This is effected by making the student discover and tabulate the reactions for himself. Thus, the mere mechanical following of directions is, to a great extent, avoided, and the student is freed from the burden of making his own observations correspond with the printed information in his text-book. For an elementary book the subject is very fully treated. It is not intended to be used without some assistance from the demonstrator, and consequently many details of manipulation are suppressed.

J. B. C.

British Rainfall, 1902. Compiled by H. Sowerby Wallis and Dr. H. R. Mill. Pp. lxxvi + 250. (London: E. Stanford.) Price 10*s.*

THIS valuable work, which has appeared yearly since 1860, is perhaps better known to the scientific world than any other work on meteorological subjects; it has become a unique and indispensable epitome of reference on all questions relating to the distribution of rain over the British Islands. Each year adds to its importance, owing to the longer period over which the averages extend, and the nearly constant addition to the number of stations dealt with. These now amount to about 3500, and have increased 40 per cent. during the last fifteen years. It is highly creditable to the compilers that they have been able to issue the volume six months after the close of the year, within which time every record has been carefully revised prior to publication. In addition to the usual tables, the present volume contains an exhaustive discussion of the rainfall at Camden Square for the forty-five years 1858–1902, by Mr. H. Sowerby Wallis. Illustrations and notes upon the unusual occurrences of the year 1902 greatly enhance the usefulness of the volume.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

The Amount of Emanation and Helium from Radium.

IN connection with the very striking experiments described by Sir William Ramsay and Mr. Soddy in NATURE of August 13, in which they have observed the presence of helium in the gases obtained from radium bromide and also the production of helium by the emanation of radium, it may be of interest to give some calculations of the probable amount of emanation and of helium produced by radium on the disintegration hypothesis, recently put forward by Mr. Soddy and myself to explain the phenomena of radio-activity.

A method of calculation has already been indicated by us (*Phil. Mag.*, May), but the data on which it was based are somewhat imperfect. A more accurate estimate can be made from the data of the amount of heat liberated by radium, recently measured by Curie and Laborde.

I have shown that the α or easily absorbed rays from radium consist of a stream of positively charged bodies, of mass about twice that of the hydrogen atom, projected with a velocity of about $2{\cdot}5\times10^9$ cm. per sec. These results have been recently confirmed by Des Coudres. These α bodies are expelled from every part of the mass of radium, but in consequence of the ease with which they are absorbed, only a small proportion of them escapes into the air. This self-bombardment of the radium probably gives rise to a large proportion of the heat which keeps the radium at a temperature above that of the surrounding atmosphere. Assuming for the moment that all of the heat is supplied by this continuous bombardment, an estimate can readily be made of the number of α bodies projected per second from one gramme of radium.

The kinetic energy of each projected body is 5×10^{-6} ergs. Since this energy is transformed into heat in the mass of radium, the number of bodies projected to give an emission of heat of 100 gr. cals. per hour—the amount determined by Curie and Laborde—can be shown to be $2{\cdot}4\times10^{11}$ per second. Now Townsend has shown from experimental data that $Ne=1{\cdot}22\times10^{10}$, where N is the number of atoms in 1 c.c. of gas at standard pressure and temperature, and e is the charge carried by an ion. The latest value of e, found by J. J. Thomson, is $3{\cdot}4\times10^{-10}$, so that $N=3{\cdot}6\times10^{19}$.

If the α bodies after expulsion can exist in the gaseous form, the volume of the gas produced (at standard pressure and temperature) is thus $\frac{2{\cdot}4\times10^{11}}{3{\cdot}6\times10^{19}}=6{\cdot}7\times10^{-9}$ c.c. per sec. or 0·21 c.c. per year. Allowing a wide margin for the possibility that only one-tenth of the heat emitted by radium is due to the kinetic energy of the projected bodies, the volume of the α particles should lie between 0·021 c.c. and 0·21 c.c. per year for each gramme of radium.

The determination of the mass of the α body, taken in conjunction with the experiments on the production of helium by the emanation, supports the view that the α particle is in reality helium. In addition, the remarkable experiment of Sir William and Lady Huggins in which they found that the spectrum of the phosphorescent light of radium consisted of bright lines, some of which within the limit of error were coincident with the lines of helium in the ultra-violet, strongly supports such a view. For as a consequence of the violent expulsion of the α particle, it

is to be expected that it would be set into powerful vibration and give its characteristic spectrum.

In the experiments of Sir William Ramsay and Mr. Soddy 30 milligrammes of radium bromide, probably about four months old, were used. If the α body is helium, the amount of helium liberated by solution of the radium in water must have been between 0·00017 and 0·0017 c.c., assuming that all of the helium produced was occluded in the mass of the substance.

There is evidence of at least five distinct changes occurring in radium, each of which is accompanied by the expulsion of an α particle. One of the products of these changes is the radium emanation. It is of interest to calculate the volume of the emanation occluded in radium when in a state of radio-active equilibrium. Taking as the simplest hypothesis that one α particle is projected at each change, the number of atoms of the emanation produced per second is $1/5$ of the number of α particles, *i.e.* $1{\cdot}3 \times 10^{-9}$ c.c. When radio-active equilibrium is reached, it has been shown that 463,000 times the amount of emanation produced per second is stored up in the radium. This corresponds to 6×10^{-4} c.c. The maximum amount of emanation to be obtained from one gramme of radium thus probably lies between 6×10^{-5} c.c. and 6×10^{-4} c.c.

The radium emanation is the active principle of radium, for about $\frac{3}{4}$ of the activity of radium is due to it. Thus a large proportion of the radiations from radium is a direct result of the changes occurring in the very minute amount of matter constituting the radium emanation. If ever 1 c.c. of the radium emanation can be collected at one spot, it will exhibit some remarkable properties. The powerful radiations from it would heat to a red heat, if they would not melt down, the glass tube which contains it. This very rapid emission of energy, in comparison with the amount of matter producing it, would continue for several days without much change, and would be appreciable after a month's interval. The very penetrating rays from it would light up an X-ray screen brilliantly through a foot of solid iron.

E. RUTHERFORD.

Bettws-y-Coed, August 15.

Summer Lightning.

ALTHOUGH a good deal has been written on the subject of "summer lightning," it may not be superfluous to describe a display of the phenomenon which occurred here last evening on a scale far surpassing anything which it had been my good fortune to witness before. There had been several thunderstorms in the district during the previous five or six days, and a few peals were heard and heavy rain fell in the early afternoon of the day before (August 13). But the sky cleared rapidly thereafter, and the evening and night of that day were cloudless, every peak and crest standing out sharply defined in the clear air. Yesterday was still fine, but warmer and less bracing than visitors here expect. Late in the afternoon wisps of white mist began to gather round the summit of the Jungfrau, and streaks of thin cloud took shape in the higher air above the great mountain ridge that extends from the Silberhorn to the Breithorn. About 8 p.m. I noticed a faint quivering light overhead, supplemented by occasional flashes of greater brilliance and different colour. These manifestations rapidly increased in distinctness, and continued to play only along the opposite mountain-ridge, not extending into the regions beyond, so far as these could be seen from here, though I have since learnt that an independent series of flashes was seen around the Schilthorn on this side of the valley. Not a single peal of thunder was at any time audible. A long bank of cloud formed at a higher level than the summits of the mountain-ridge, and at some distance on the further side of it, so that the stars, elsewhere brilliant, were hidden along the strip of sky above the crest.

As one watched the display it was easy to distinguish more definitely the two kinds of discharge. One of them took the form of a faintly luminous reddish or pink light, which shot with a tremulous streamer-like motion in horizontal beams that proceeded apparently from left to right, as if their starting point lay somewhere about the back of the Jungfrau. These streamers so closely resembled the *aurora borealis* that, had they appeared alone, one would have been inclined to wonder whether the "northern lights" had not here made an incursion into more southern latitudes. So feeble were they when they sped across the clear sky that the stars were clearly visible through them. Sometimes they quivered on the far side of the cloud, lighting up its edges and shooting beyond it across the still unclouded blue. At other times they appeared on this side of the cloud, and showed the dark outline of the mountains in clear relief against the luminous background. They so rapidly succeeded each other that they might be said to be continuous, a faint pinkish luminosity seeming to remain always visible, though pulsating in rapid vibrations of horizontal streamers.

The brighter discharges were not only far more brilliant, but much more momentary. They had a pale bluish-white colour, and came and went with the rapidity of ordinary lightning. But they were clearly connected with the mountains, and not reflections from a series of distant flashes. Sometimes they arose on the other side of the great ridge, allowing its jagged crest to be seen against the illuminated surface of the cloud beyond, but leaving all the precipices and slopes on this side in shade. In other cases they clearly showed themselves on this side of the mountains, lighting up especially the snow-basins and glaciers with the dark crags around them. Nothing of the nature of forked lightning was observed among them. In one instance the flash or horizontal band of vivid light, a mile or two in length, seemed to shoot upward from the slope at the base of the precipices of the Silberhorn, as if it sprang out of the ground, having a sharply defined and brilliant base, rapidly diminishing in intensity upward, and vanishing before reaching half-way up to the crest.

But the most singular feature of the more brilliant white discharges was to be seen when one of the great couloirs of snow or a portion of a glacier remained for a minute or two continuously luminous with a faint bluish-white light. After an interval the same or another portion, perhaps several miles distant, would gleam out in the same way. My first impression was that this radiance could only be a reflection from some illuminated part of the cloud. But I could not satisfy myself of the existence of any continuously bright portions of the cloud. Moreover, the luminosity of the snow and ice remained local and sporadic, as if the beam of a search-light had been directed to one special part of the mountain declivity, and then after a while to another. While watching one of these patches of illumination, I noticed a bright point of light at the top of one of the basins of *nevé* on the slopes of the Mittaghorn. It quickly vanished, but soon reappeared, and then as rapidly was lost again. I thought that it was probably a star briefly exposed through rifts in the cloud, though its position seemed rather below that of the mountain-crest. Half an hour later, however, a similar bright light appeared about the same place, more diffused than the first, and having a somewhat elongated shape. Whether it was really a star seen through the distorting medium of a wreath of mist, or a form of St. Elmo's fire clinging to some peak on the precipice, could not be ascertained from its momentary visibility.

I learnt this morning that other observers who could watch at the same time the mountain ridges on each side of the Lauterbrunnen valley noticed that sheet-lightning was also playing about the Schilthorn, but quite independently of that on the Jungfrau range, the one mountain being dark, while the other was illuminated. The distance of the two electric centres from each other is between five and six miles. The whole display last evening afforded an admirably complete demonstration of the erroneousness of the notion formerly prevalent that summer lightning is only the reflection of distant ordinary lightning, and of the truth of the more recent views as to the nature of the phenomenon.

I may add that, as the lightning increased, the air, which